

JUL 22 05 10:03a

J C WRAY

RECEIVED
CENTRAL FAX CENTER 03 448-7397

p. 1

JUL 22 2005

09/852616

CERTIFICATE OF TRANSMISSION
I hereby certify that this five-page correspondence is being
facsimile transmitted to the Patent and Trademark Office (Fax No.
571-273-8300)

On 7/22/05
(Date)

Julie H. Gamotis
Julie H. Gamotis

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Certificate

JUL 26 2005

of Correction

In re Patent of

Fax: 571-273-8300

LANG et al.

Patent No. 6,901,873

Patent Date: June 7, 2005

For: LOW-DRAG HYDRODYNAMIC SURFACES

REQUEST FOR CERTIFICATE OF CORRECTION

To the Director of the Patent and Trademark Office

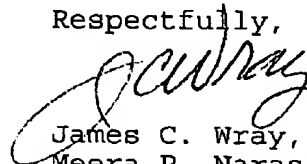
Sir:

Kindly accept and enter the attached Certificate of
Correction for the above-identified patent.

Also attached is a marked-up copy of the title page of the
patent, and a copy of the originally filed declaration showing
the correct address of the second inventor.

Since the error originated in the Patent and Trademark
Office, no fee is required.

Respectfully,



James C. Wray, Reg. No. 22,693
Meera P. Narasimhan, Reg. No. 40,252
Matthew J. Laskoski, Reg. No. 55,360
1493 Chain Bridge Road
Suite 300
McLean, Virginia 22101
Tel: (703) 442-4800
Fax: (703) 448-7397

July 22, 2005

JUL 28 2005

JUL 22 05 10:03a

J C WRAY

RECEIVED
CENTRAL FAX CENTER 703 448-7397

P.2

JUL 22 2005

JUL 12 05 12:35p

J C WRAY

703 448-7397

P.2

PTO/SB/44 (04-04)
Approved for use through 04/30/2007. OMB 0551-0033
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.
(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,901,873
DATED : June 7, 2005
INVENTOR(S) : Thomas G. Lang and James T. Lang

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title Page

Item (76), line 3.

The street address of the second inventor should read:

559 Homer Avenue

MAILING ADDRESS OF SENDER:

James C. Wray
1493 Chain Bridge Road, Suite 300
McLean, VA 22101

PATENT NO. 6,901,872

No. of additional copies

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete. Including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PAGE 2/5 * RCVD AT 7/12/2005 1:29:35 PM [Eastern Daylight Time] * SVR:USPTO-EFXXRF-1/4 * DNIS:8729308 * CSID:703 448 7397 * DURATION (mm-ss):02-16

PAGE 2/5 * RCVD AT 7/22/2005 10:57:57 AM [Eastern Daylight Time] * SVR:USPTO-EFXXRF-8/25 * DNIS:2738300 * CSID:703 448 7397 * DURATION (mm-ss):02-28

JUL 28 2005



US 6,901,873 B1

(12) **United States Patent**
Lang et al.

(10) Patent No.: **US 6,901,873 B1**
(45) Date of Patent: **Jun. 7, 2005**

(54) **LOW-DRAG HYDRODYNAMIC SURFACES**

(76) Inventors: Thomas G. Lang, 417 Loma Large Dr.,
Salona Beach, CA (US) 92075; James
T. Lang, 559 Homer Ave., Palo Alto,
CA (US) 94301

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: 09/852,616

(22) Filed: May 11, 2001

Related U.S. Application Data

(60) Continuation-in-part of application No. 09/689,698,
filed on Oct. 13, 2000, now Pat. No. 6,439,148, which
is a division of application No. 08/948,242, filed on
Oct. 9, 1997, now Pat. No. 6,167,829.

(51) Int. Cl. B63B 1/38; B63B 1/28
(52) U.S. Cl. 114/67 A; 114/61.1; 114/278;
114/280; 114/289

(58) Field of Search 114/67 A, 277,
114/278, 61.1, 61.12, 271-275, 280-282,
114/288-290; 244/204, 207-212

(56) **References Cited**

U.S. PATENT DOCUMENTS

986,766 A * 3/1911 Schroeder 440/44
1,003,364 A * 9/1911 Langston 114/290
1,030,517 A * 1/1913 Chase
1,121,006 A 12/1914 Fieber
1,389,865 A * 9/1921 Fox 114/67 A
1,621,625 A * 3/1927 Casey
3,044,432 A * 7/1962 Wennagel
3,109,495 A 11/1963 Lang
3,199,484 A 8/1965 Wiberg
3,203,389 A 8/1965 Calc

3,467,043 A 9/1969 Bowles
(Continued)

FOREIGN PATENT DOCUMENTS

JP 61081283 A * 4/1986 B63B 1/38
(Continued)

OTHER PUBLICATIONS

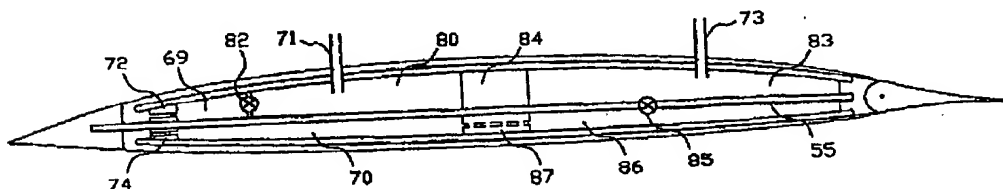
(No named author); *State-of-the-Art Investigation on Artificial Cavity Ships*; Project Report, Ship Hydrodynamic Division, Krylov Shipbuilding Research Institute, St. Petersburg, Russia, Feb. 2001; 70 pages.

Primary Examiner—S. Joseph Morano
Assistant Examiner—Ajay Vasudeva
(74) Attorney, Agent, or Firm—James Creighton Wray;
Meera P. Narasimhan

(57) **ABSTRACT**

The invention relates to the use of gas cavities to reduce frictional drag on underwater surfaces such as hydrofoils, struts, fins, rudders, keels, propeller blades, ship hulls, underwater bodies, and wetted surfaces in general. Each gas-filled cavity is formed behind a discontinuity in the surface that causes the water boundary layer to separate from the surface. Gas is ejected into a region behind the discontinuity to fill the cavity; the gas can be air. If a cavity is open to the atmosphere, then air can typically fill the cavity naturally without air ejection. Cavities can either be closed or open. A low drag hydrofoil may have a closed cavity on one side, and an open cavity on the other side. For closed cavities, the underlying surface can be shaped to minimize cavity closure drag. Various ways to generate cavities, change hydrodynamic forces, and duct gas internally on hydrofoils and struts with cavities are covered. Different designs of hydrofoil boats, hydrofoil ships and ship hulls that are amenable to drag reduction are presented.

223 Claims, 12 Drawing Sheets



Please type a plus sign (+) inside this box → ☐

Approved for use through 10/31/2002. OMB 0651-0032
 U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
 Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63) <input checked="" type="checkbox"/> Declaration Submitted with Initial Filing OR <input type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)	Attorney Docket Number	
	First Named Inventor	LANG
	COMPLETE IF KNOWN	
	Application Number	/
	Filing Date	05/11/2001
	Group Art Unit	
Examiner Name		

As a below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Low-Drag Hydrodynamic Surfaces

(Title of the Invention)

the specification of which

☒ is attached hereto

OR

☐ was filed on (MM/DD/YYYY) [] as United States Application Number or PCT International Application Number [] and was amended on (MM/DD/YYYY) [] (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT International filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 385(b) of any foreign application(s) for patent or inventor's certificate, or 385(a) of any PCT International application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

[Page 1 of 2]

Burden Hour Statement: This form is estimated to take 21 minutes to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

Please type a plus sign (+) inside the box → ☐

Approved for use through 10/31/2005, OMB # 0611-0032
 U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number.

DECLARATION — Utility or Design Patent Application

Direct all correspondence to: <input type="checkbox"/> Customer Number or Bar Code Label		<input checked="" type="checkbox"/> Correspondence address below	
Name JAMES C. WRAY			
Address 1693 Chain Bridge Road			
Address Suite 300			
City McLean	State VA	ZIP 22101	
Country US	Telephone (703) 442-4800	Fax (703) 448-7397	
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.			
NAME OF SOLE OR FIRST INVENTOR:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name Thomas C. (first and middle (if any))		Family Name Lang or Surname	
Inventor's Signature <i>Thomas C. Lang</i>		Date 5/10/01	
Residence City Solana Beach	State CA	Country US	Citizenship US
Mailing Address 417 Loma Larga Drive			
Mailing Address			
City Solana Beach	State CA	ZIP 92075	Country US
NAME OF SECOND INVENTOR:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name James T. (first and middle (if any))		Family Name Lang or Surname	
Inventor's Signature <i>James T. Lang</i>		Date 5/10/01	
Residence City Palo Alto	State CA	Country US	Citizenship US
Mailing Address 599 Homer Avenue			
Mailing Address			
City Palo Alto	State CA	ZIP 94303	Country US
<input type="checkbox"/> Additional inventors are being named on the supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.			

(Page 2 of 2)